



The Power to Control.



Storage solutions supporting Renewables Integration & Development

September 12, 2012

Xtreme Power, Inc.

Company Overview



Xtreme Power engineers and integrates power management and energy storage solutions

- Founded in 2004 in Austin, Texas; ~ 270 employees
- HQ in Austin, TX with operations in Kyle & OK; International presence
- Established Beijing Office
- Projects installed, contracted, and in final negotiations: >70 MVA, across 12 projects
- Utility industry leadership on Board of Directors
 - Pat Wood, Former FERC Chairman, and
 - Foster Duncan, Former EVP/CFO of Cinergy
- Over \$80 MM in funding raised from:



Xtreme Power's Proven Experience



Xtreme Power's experience includes:



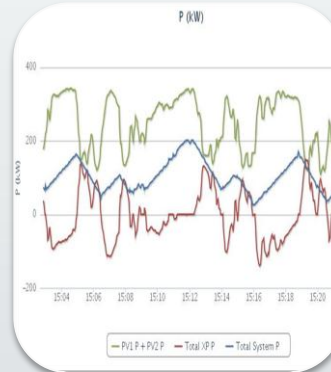
77

Megawatts
Installed by
End of 2012



> ~148,520

Hours of
Integrated
Power Module
Operation



327

Gigabytes of
Recorded Data



> ~3 GWh

Energy
Charged and
Discharged

Leading the Market with Operational Experience

▶ Today's discussion...



- Why Storage?
- Proven Renewable Applications
- Opportunities for Storage in the Texas market
- Regulatory framework & Recent Developments

Why Storage?



1. **Responsive** - provides **fast** and **accurate** response to dispatch signals to support second-by-second system operation needs
2. **Flexible** – additional tool for **managing variability** on the system → **reduced dependency** on large conventional plant, more efficient use of existing T&D
3. **Reliable** - supplies **new sources of ancillary services**, reducing Minimum-Generation requirements and related emissions impacts
4. **Resource support** - supports ongoing integration of “new” technologies to ERCOT e.g. Renewable energy facilities, and evolving grid needs
5. **Grid support** - potential **option for T&D solutions** leading to deferred T&D investment & customer savings (e.g., Presidio)

Growing portfolio of Storage projects in service



Project	Customer	Application	Power Rating / Duration	COD	Services
Deployed Projects					
South Pole Telescope (SPT)	University of Chicago	Microgrid	0.5 MVA, 5 min	4Q 2006	Peak-Shaving
Kahuku	First Wind	Renewable Integration	15.0 MVA, 15 min	1Q 2011	Ramp Control, Curtailment Mitigation
Lanai	Castle & Cook	Renewable Integration	1.1 MVA , 15 min	2Q 2011	Ramp Control, Frequency Response
Ford Michigan Assembly Plant	Ford, DTE Energy	Demand Management	0.75 MVA, 60 min	2Q 2011	Load-Leveling, Ramp Control
KIUC	Kaua'i Island Utility Coop	Grid Support	1.5 MVA, 15 min	3Q 2011	Frequency Response, VAR Support
Nova	Xcel Energy	Renewable Integration	1.5 MVA, 15 min	4Q 2011	Ramp Control, Firming & Shaping, Frequency Response, VAR Support
KWP II (Maui)	First Wind	Renewable Integration	10.0 MVA, 45 min	2Q 2012	Ramp Control, Responsive Reserves, Grid Services
Ture	Classified	Renewable Integration	1.5 MVA, 15 minutes	2Q 2012	Ramp Control & VAR Support
Total Operating	8 Customers	4 Applications	~31 MVA	8 Projects	9 Services
Near-Term Projects					
KIUC II	Kaua'i Island Utility Coop	Grid Support	1.5 MVA, 15 min	3Q 2012	Responsive Reserves, Ramp Control, Grid Services
KIUC III	Kaua'i Island Utility Coop	Grid Support	1.5 MVA, 15 min	3Q 2012	Responsive Reserves, Ramp Control, Grid Services
Notrees	Duke Energy	Merchant Services	36.0 MVA, 15 min	4Q 2012	Responsive Reserves, Regulation Services, Grid Services
Fosters	Classified	Microgrid	3.0 MVA, 15 min	4Q 2012	Uninterruptible Power Source
Bear	Kodiak Electric	Grid Support	3.0 MVA, 15 min	4Q 2012	Frequency response, Responsive Reserves, Voltage Support
Total Near-Term	3 New Customers	3 Applications	46 MW	5 Projects	

9 Customers, 5 Applications & 10 Services To Date in Deployed Projects

~ 77 MVA, 154 MW Dynamic Power Range in Deployed Projects

Storage services supporting Renewable integration



Direct Support	Project Challenges		Storage Solutions
Renewable Developers & Operators	<ul style="list-style-type: none"> • Intermittent Supply • Curtailed Production • Power quality concerns • Uncorrelated Generation & Demand 	➔	<ul style="list-style-type: none"> • Smooth Generation Variability • Optimize Asset Value • Safeguard power quality standards • Reshape Output to Meet Demand
Indirect Support	System Challenges		Storage Solutions
Market & System Support	<ul style="list-style-type: none"> • Higher grid stability uncertainty • Additional balancing services • Greater need for flexibility -> higher O&M risk on conventional, ramp-limited plant • Less efficient Use of Grid/T&D Resources 	➔	<ul style="list-style-type: none"> • Fast-responding, Dispatchable Ancillary Service • Reduced reliance on conventional Gen to correct Grid Imbalances • Maximize Productivity of Renewable Generation

Wind Case: Kaheawa Wind Power II

Increasing Revenues, New source of Reserves



Location	Maui, HI
Segment	Renewable Integration
DPR	10 MVA, 45 minute duration
Dynamic Power	20 MW
COD	Q2 2012
Services	Ramp Control, Curtailment Capture, Responsive Reserves



XP Dynamic Power Resource™ operates on a 21 MW wind farm on the island of Maui:

- (1) Provides WF Ramp control and Frequency/Voltage regulation service
- (2) Provides Maui Electric Company (MECO) with additional source of Responsive Reserves allowing greater wind penetration.

Solar Case: Lanai Solar



Customer:	Lanai Sustainability Research
Location:	Lanai, HI
Grid Size:	4 MW peak load
DPR Size:	1.125 MW, 15 min duration
Application:	Ramp Control & Frequency Response



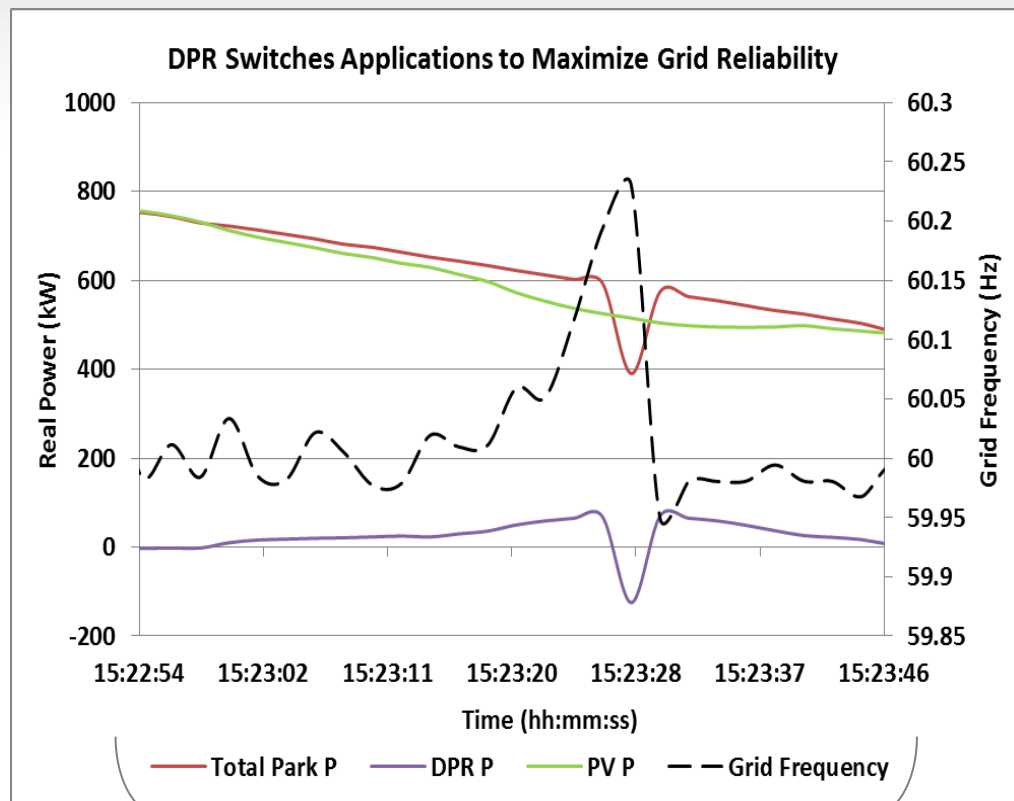
■ Customer Challenge:

- Relatively small grid with high % of renewables
- Curtailment required to maintain grid frequency
- High cost of diesel fuel for diesel Gen providing grid support
- Desire for higher levels of Solar PV integration
- **Facility curtailed to 50% capacity without intermittency solution**

Solar Case: Lanai Project



XP XACT™ control system automatically switches between predesigned applications.

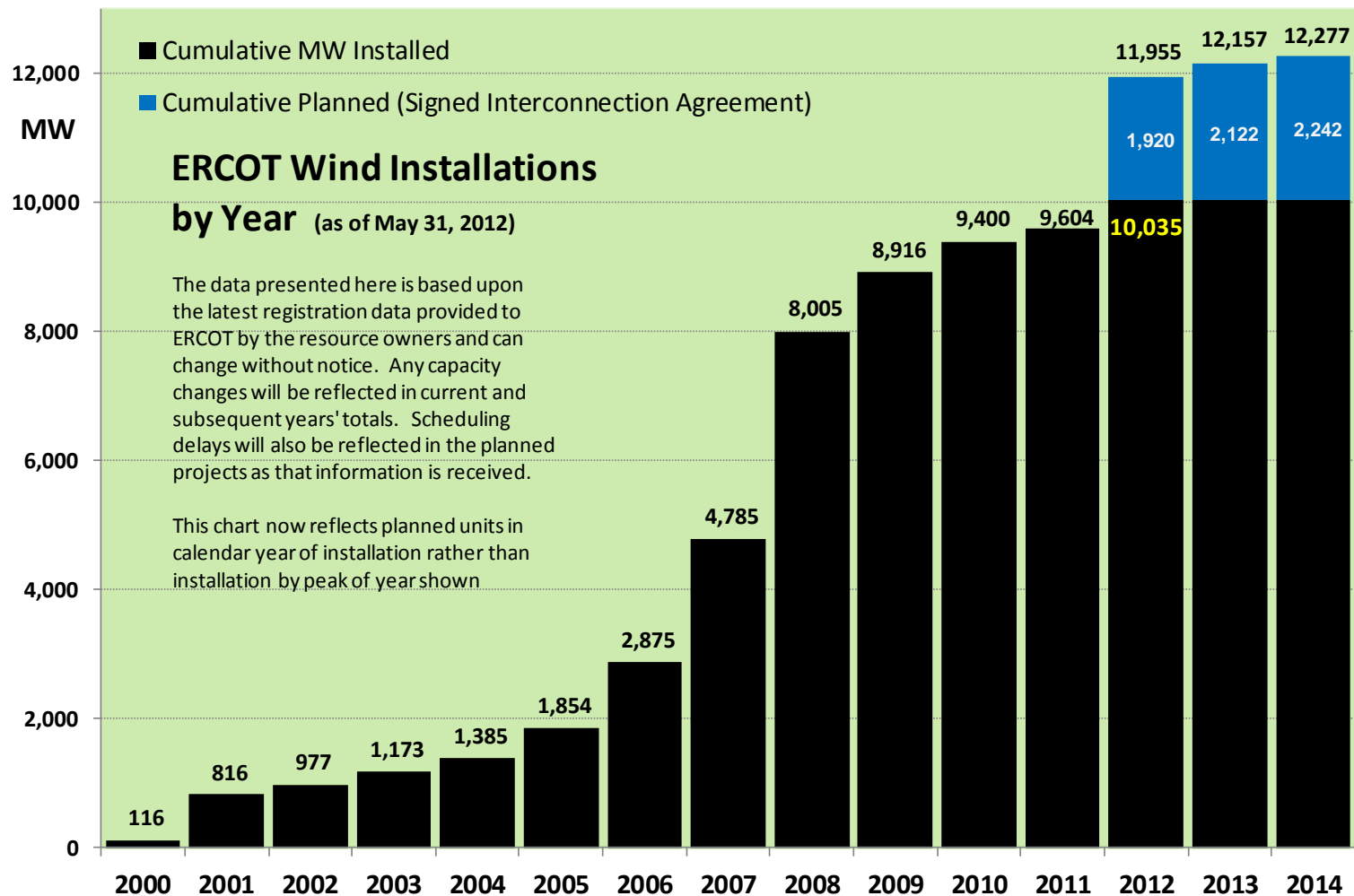


Over 70,000 frequency events in first 4-mo

- Green line shows solar PV ramping down too quickly causing the DPR (purple line) to maintain required ramp rate of ± 360 kW/min
- Grid frequency (black line) exceeds 60.2 Hz, in violation of PPA
- DPR seamlessly switches modes and begins to charge, following a pre-defined frequency response.
- After solving frequency deviation, DPR seamlessly reverts back to Ramp Control.

What does this mean for TX Renewables?

10,000 MW of Deployed Renewables, 18,000 MW on the way



Texas Has a Partially De-regulated Electric Market

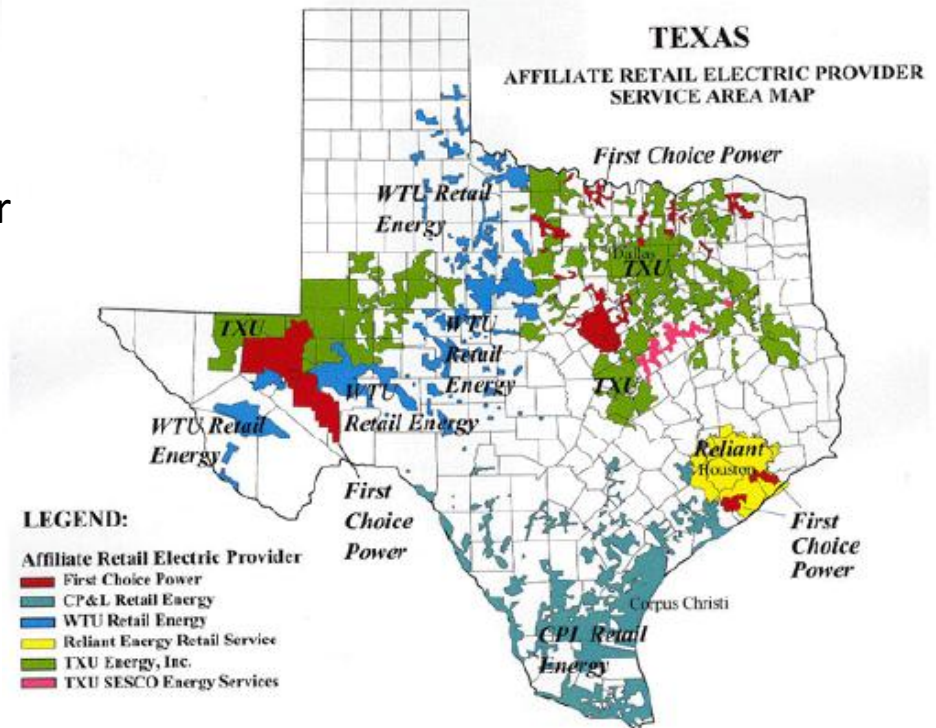


- In competitive areas, utilities are unbundled into generators, TDSPs, and REPs

- Other areas are served by munis, co-ops, or IOUs

- Where does Storage fit?

- *Multiple application options*
- *Value proposition will vary by application and by area*



Result: Opportunities for Storage Services in Texas



❑ **New provider** of Ancillary Services

- Faster, more accurate response from 'Fast-Regulation' for efficient frequency control and grid balancing
- Fast-ramping-regulation leading to reduced overall regulation service need
- Frees up conventional generation to participate in the energy market

❑ **New solutions** for Renewables Integration & Operation

- Maximizes production from intermittent resources
- Option to firm and shape load
- Facilitates Time-shifting in response to market price signals
- Helps with ramp control, power quality requirements

Storage resources likely will offer a combination of both –

Key is Market Access!

Summary of Recent TX Developments



■ Texas Legislature

- SB 943 passed in 2011 to clarify rights of storage resources providing wholesale service(s) in competitive areas
- Confirmed right to interconnect similar to generators, but uncertainty remains for storage in other markets and applications

■ Public Utility Commission of Texas

- Multiple projects and rulemakings to explore issues and remove barriers for storage, including new settlement rules and granting authority for ERCOT to establish pilot projects for emerging technologies

■ ERCOT

- Emerging Technologies Working Group (ETWG)
- Fast Response Regulation Service (FRRS) pilot
- Settlement protocols being drafted to allow storage participation in the market

Public Utility Commission Details



Specific Actions:

- Project 39764 explored general storage issues
- Project 39657 was the rulemaking to implement SB 943
- Project 40150 was the rulemaking for ERCOT pilot project authority
- Project 39917 was the rulemaking for settlement issues
 - Also exempted storage from retail load fees and 4CP cost allocation methods

“We need to remove as many impediments to storage as we can.” - Texas PUC,
September 2011



Specific Actions:

- Established Emerging Technologies Working Group (ETWG)
- Establishing Fast Responding Regulation Service (FRRS) pilot
- Drafting protocols for the storage settlement rule (wholesale treatment of storage load)

Duke Notrees

World's Largest Battery Energy Storage System with Wind



Location	Odessa, TX
Segment	Merchant Services
DPR	36 MVA, 15 minute duration
Dynamic Power	72 MW
COD	Q4 2012
Services	Ramp Control, Frequency Regulation, and Voltage Support



Duke Energy plans to match a \$22 million grant from the U.S. Department of Energy to install a DPR capable of storing electricity produced by Duke's 153 MW Notrees wind farm. After due diligence, Duke Energy chose Xtreme Power to design, install and operate the largest battery storage system in the world integrated with a wind farm.



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